Effect of Publicly Released Quality Information for US Hard Red Winter Wheat on Mexican Millers' Welfare

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Growth in domestic demand has caused Mexico to increase its dependence on wheat imports. The United Nations' Food and Agriculture Organization reports that Mexican wheat imports increased over 800% in 15 years, from 442,800 MT in 1990 to 4,066,500 MT in 2005 (FAO 2007). A factor contributing to the increase in wheat imports is the disparity between the type of wheat that is primarily produced in Mexico and the type of wheat demanded by consumers. Mexico's primarily produces durum-type wheat which is used to make noodles and pasta. By contrast, most of the wheat imported and used by domestic consumers is hard wheat suitable for making bakery products. For example, from 2000 to 2006, durum wheat accounted for about 91% of all wheat produced in Mexico (SAGARPA 2007).

The growth in demand for hard wheat in Mexico has been beneficial for U.S. wheat producers. Mexico is the third largest wheat importer of U.S. wheat, ranked after Egypt and Japan and is the largest single-country buyer of U.S. hard red winter wheat produced in the U.S. Southern Plains. Canada is the largest competitor in supplying wheat to Mexico. From 1997-2007, Mexico imported 24,525,756 MT of wheat from the U.S. and 10,206,818 MT from Canada (FAS/USDA 2007, Statistics Canada 2007). The U.S. has a geographic advantage over Canada, being able to offer more competitive prices given lower transportation costs. Additionally, Mexican millers prefer rail to ocean-vessel transportation, and the well-established rail system between U.S. and Mexico favors U.S. exports (Gallardo, 2007).

Despite the transportation advantages the U.S. maintains over Canada in serving the Mexican market, Canadian wheat exhibits consistent quality, primarily as a result of a strong export regulatory board (Lavoie 2005; Mejía and Rosales 2004). Indeed, U.S. wheat quality has been questioned for over two decades. Mexican milling companies' concern is the lack of consistency in U.S. wheat quality and that the quality of wheat received does not always coincide with the quality specifications prior to shipment (Gallardo, 2007). The information supplied by the current U.S. wheat quality grades are primarily based on physical characteristics including test weight, damaged, shrunken, and broken kernels, foreign material, and total defects. This information provides little or no information about end-use (baking) characteristics, which is of interest to the millers striving to meet clients' requirements (Lyford et al. 2004).

These observations have prompted some U.S. wheat exporters to argue that selling wheat based solely on current grades and standards is insufficient. Changing the existing standards is likely cost prohibitive (Mercier 1993) and it is likely to be inefficient to information on end-use quality characteristics for transaction made in the market. An alternative that has been proposed to improve the supply of information is to identify more detailed information on wheat quality characteristics by U.S. region and provide this information to foreign buyers.

To address these perceived informational gaps in the system, non-profit organizations have been created, e.g., the Wheat Marketing Center in Portland, OR and Plain Grains Inc. (PGI) in Stillwater, OK. PGI is an organization created in 2004 to assist producers, millers, and bakers by providing geographically-based quality information for each year's hard red winter wheat crop. They facilitate sampling and quality testing of hard red winter wheat from the production area of Texas, Oklahoma, Kansas, Nebraska, Colorado, South Dakota, and Montana. The disaggregated regional information is published for every crop year on both the PGI and the U.S. Wheat Associates websites. In addition, PGI conducts educational workshops on grain quality and the baking process, and PGI personnel travel to Mexico to promote the quality findings directly to Mexican millers (Regnier and Holcomb 2004).

An open question is the whether there is any value to the information being disseminated by organizations such as PGI. In this study, we model the effect of the increased accessibility to wheat quality information provided by PGI on Mexican milling companies' welfare. PGI marketing expenditures are as a proxy for access to information, and this variable is included in an estimation of a system of equations including the Mexican millers' cost function and source-differentiated factor demands. By investigating how Mexican millers' costs change as accessibility to information changes, we are able to calculate the value of information provision.

Conceptual Framework

In this paper, we built this study on the seminal papers by Foster and Just (1998) and Teisl, Bockstael, and Levy (2001) related to the value of information. These previous studies estimated the effect of information related to milk contamination and nutritional information on consumers' welfare. In this study, we move from the consumer to the firm and apply the approach taken by Foster and Just (1998) and Teisl, Bockstael, and Levy (2001) to the firms' cost function. Wheat is treated as an input in the production of flour and, following studies such as Marsh et al. (2005), Koo, Mao, and Sakurai (2001), and Lavoie (2005), we treat wheat from various countries as separate, source-differentiated inputs in the production process.

Mexican milling companies' are assumed to minimize cost, as given by:

(1) $$\min_{x} C = C(x, w, q) \text{ subject to } y = f(x)$$

where C is the cost function, x represents the vector of inputs, w represents the vector of input prices, y is the output level, and q is the quality of input x. As in Foster and Just (1998), quality is assumed to be uncertain and its probability distribution is described by the parameters θ. Millers choosing x to minimize equation (1), resulting in the optimal input quantities, x^*.

Substituting these optimal input quantities back into equation (1) yields the indirect cost function given by $C(w, \overline{Y}, \theta)$ where $\overline{Y}$ is the optimal output required to minimize cost.

Now, assume there is a change in input quality from θ_0 to θ_1, where in our case θ_1 may be higher or lower than θ_0 depending on the conditions of the crop-year. If firms have perfect information, they are fully aware of the quality change, and welfare gains are captured by the difference between the firms' minimum costs associated with qualities θ_0 and θ_1. In other words, if firms have perfect information, they will be able to adjust their use of input from x_0 to x_1 when quality changes from θ_0 to θ_1. In this case, the change in welfare resulting from the quality change is represented by the compensating variation (*CV*):

(2) $$CV = C(w_0, \overline{Y}_0, \theta_1) - C(w_0, \overline{Y}_0, \theta_0)$$

What if firms are not informed about the change in input quality? If firms are unaware of the change in quality of *x*, they will not modify their input use appropriately. That is, the firms continue to use input quantities which are now sub-optimal given the (unknown to the firm) change in quality. Foster and Just (1998) referred to this inefficiency as the cost of ignorance, which is a measure of the welfare effect of changing quality under imperfect information. When firms are unaware of a quality change, they experienced higher or lower welfare than in (2) depending on the nature of the change in quality. The welfare gain/loss of the uninformed firms is given by the compensating surplus (*CS*) measure:

(3) $$CS = \tilde{C}(w_0, \overline{Y}_0, \theta_1; x_0) - C(w_0, \overline{Y}_0, \theta_0)$$

where $\tilde{C}(w_0, Y_0, \theta_1; x_0)$ represents the cost where *x* is constrained to be at the level that would be optimal if no change in quality had occurred. The cost of ignorance (or the value of information) is given by the difference between (2) and (3).

(4) $$COI = CS - CV = \tilde{C}(w_0, \bar{Y}_0, \theta_1; x_0) - C(w_0, \bar{Y}_0, \theta_1)$$

By construction, cost of ignorance (*COI*) is negative: If the change in quality is positive, the gains in *CS* would be smaller than *CV*. If the change is negative, the losses in *CV* would be greater than *CS*.

To facilitate the estimation of *COI*, we follow Foster and Just (1998) and defined a vector of input prices, w_1, associated with the quality distribution θ_1. Before the quality change, there is an initial level of input prices, output quantity, and input quality $(w_0, \bar{Y}_0, \theta_0)$. If there is a change in input quality from θ_0 to θ_1, then w_1 would be the price for x_0, the initial level of input use. The difference between w_0 and w_1 is the difference in input prices required to induce firms to purchase x_0. Hence, *CS* can be alternatively represented by:

(5) $$CS = \left[C(w_1, \bar{Y}_0, \theta_1) - w_1 x_0\right] - \left[C(w_0, \bar{Y}_0, \theta_0) - w_0 x_0\right] = C(w_1, \bar{Y}_0, \theta_1) - C(w_0, \bar{Y}_0, \theta_0) + (w_0 - w_1) x_0$$

Consequently, the cost of ignorance can be re-written as:

(6) $$COI = CS - CV = C(w_1, \bar{Y}_0, \theta_1) + (w_0 - w_1) x_0 - C(w_0, \bar{Y}_0, \theta_1)$$

As w_0 approaches w_1, the cost of ignorance approaches to zero.

Firms might possess an initial and, likely imperfect assessment of the quality of an input. The subjective distribution of the input quality assessment is given by θ_0. Information provided by a wheat marketing organization such as PGI allows millers to update their assessments. The new subjective distribution is given by θ_1, and it is at least as accurate as or more so than the initial assessment. If milling companies are prevented from receiving the information, or PGI stops operations, millers' cost of ignorance is represented by expression (6). Likewise the value of information is from PGI is -1**COI*.

Methods

Empirical model

The empirical model is based on the approach used by Marsh (2005) and Koo, Mao, and Sakurai (2001). There are two groups of inputs in flour production: wheat and other inputs such as labor, capital, and energy. A milling company's objective function is represented by:

$$\min_{x_1,x_2} C = C(x_1, x_2, w_1, w_2, \theta) = C(C_1(x_1, w_1, \theta), C_2(x_2, w_2, \theta)) \tag{7}$$

where C represents the cost function, x_1 is the vector of wheat types (US, Canadian, and Mexican wheat), x_2 is the vector for other inputs (labor, capital, and energy), w_1 is a vector of wheat prices corresponding to the prices of US, Canadian, and Mexican wheat, and w_2 is a price vector for other inputs. Following Marsh (2005), we assume weak separability in the cost function, which allows us to focus specifically on the function C_1. In addition, we assume firms are homogenous (i.e. face the same input prices, use same levels of inputs, and produce the same level of output) and that different flour types can be aggregated into a weighted average flour output quantity:

$$Y = \sum_{m=1}^{4} s y_m \tag{8}$$

where Y is the aggregated flour quantity; s is the quantity of flour type m produced, with m= soft, semi-fine, fine, extra-fine; and y_m is the flour type m quantity. These assumptions imply that the firm's indirect cost function can be written as: $C(w_1, Y, \theta)$

To model milling companies cost function, we utilize the normalized quadratic function, which represents a second order approximation to the true indirect cost function, $C(w_1, Y, \theta)$. In particular, the milling companies' normalized quadratic cost function is:

$$Costn = \alpha_0 + \beta 1 y_t + \sum_{i=1}^{2} \beta 2_i w_{it}^* y_t + \frac{1}{2} \beta 3 y_t^2 + \theta_1 w_{1,t}^* + \beta 6 w_{2,t}^*$$

(9)
$$+ \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \beta 7_{ij} w_{it}^* w_{jt}^* + \beta 8 T_t + \sum_{i=1}^{2} \beta 9_i w_{it}^* T_t + \beta 10 y_t T_t + \frac{1}{2} \beta 11 T_t^2$$

$$+ \sum_{k=1}^{3} \beta 12_k QD_k + \sum_{k=1}^{3} \beta 13_k w_1^* QD_k + \sum_{k=1}^{3} \beta 14_k w_2^* QD_k$$

where $Costn$ is the indirect cost function normalized with respect to Mexican wheat prices, α_0 is the intercept, y_t is the aggregated flour output produced in Mexico, w_1^* and w_2^* are the prices of U.S. and Canadian wheat normalized by Mexican wheat prices, T is the time trend to take into consideration effects of technology, productivity, and other factors over time, θ_1 is the function of the expenditures of U.S. non-profit wheat marketing companies, QD is the indicator variable for quarter included to take into consideration seasonality in Mexican wheat imports.

To model the effect of information availability, we used an approach similar to that in Piggott et al. (1996). They measured the effect of advertising expenditures on Australian meat demand. In this study, wheat marketing expenditures are used as a proxy to model Mexican milling companies' access to wheat quality information. Expenditures include the travel costs for PGI to visit Mexican milling companies and also include costs of PGI website development and maintenance costs where wheat quality information is published. We model expenditures as an input demand shifter. The effect of such information expenditures are likely to persist over time, meaning that current wheat purchases respond to information expenditures in previous periods. In general, we specify the information parameter associated with US wheat quality as:

(10)
$$\theta_{US,t} = \theta_0 + \sum_{k=0}^{K} \beta 4_k (PGIt_{t-k}) + \sum_{k=0}^{K} \beta 5_k (PGIw_{t-k})$$

where θ_0 is an intercept term, $PGIt_t$ represents PGI travel expenditures during time t, $PGIw_t$ are expenditures on website development and maintenance in time t, and $\beta 4_k$ and $\beta 5_k$ are the parameters representing the effect of an additional unit of travel and website expenditures respectively, in the current and lagged period $k = 0, 1, 2, \ .. K$. The appropriate number of lags, K, to include is determined by identifying the number of lags which best fit the data.[1]

Imposing symmetry $w_{ij} = w_{ji}$ and utilizing Sheppard's lemma, we obtain the input demand functions for US and Canadian Wheat:

(11) $$\frac{\partial Costn}{\partial w^*_{US}} = x_{US} = \theta_{US} + \beta 2_{US}\, y_t + \beta 7_{USCAN}\, w^*_{CANt} + \beta 7_{USUS}\, w^*_{USt} + \beta 9_{US}\, T_t$$

(12) $$\frac{\partial Costn}{\partial w^*_{CAN}} = x_{CAN} = \beta 4 + \beta 2_{CAN}\, y_t + \beta 7_{USCAN}\, w^*_{USt} + \beta 7_{CANCAN}\, w^*_{CANt} + \beta 9_{CAN}\, T_t$$

The system of equations (9)-(12) are estimated using seemingly unrelated regression (SUR) procedures. Input price elasticities are obtained by the expression:

(13) $$\varepsilon_{ij} = \frac{\partial \ln x_i}{\partial \ln w_j} = \frac{b7_{ij}\, \overline{w}^*_j}{\overline{x}_i}$$

Where $b7_{ij}$ is the estimate marginal cost of wheat imported both from the U.S. and Canada, i, j= U.S. and Canada, $\overline{w}_i$ is the average wheat price, and $\overline{x}_{ij}$ is the average quantity of imported wheat. To estimate the Mexican wheat demand elasticity we utilize the homogeneity property imposed by the normalization:

(14) $$\varepsilon_{MEX} = -\varepsilon_{US} - \varepsilon_{CAN}$$

[1] We have considered other parametrizations of equation (10). For example, one specification included a single expenditure parameter including both travel and website maintenance. Another specification assumed information expenditures had a cumulative effect over time. Overall, equation (10) appeared to provide the best fit to the data.

To estimate the value of information or cost of ignorance, observations were divided into two groups: before October 2004 when PGI started their marketing activities, and after October 2004. Subscripts 0 and 1, respectively, correspond to these two time periods. To calculate the compensating variation and compensating surplus, we used the estimated parameters and the mean prices and quantities of each variable to calculate the following statistics:

$$
\begin{aligned}
Costn\ (w_0, y_0, \theta_1) = {} & \alpha_0 + \beta 1 \overline{y}_0 + \sum_{i=1}^{2} \beta 2_{i0} \overline{w}_{i0}^* \overline{y}_0 + \frac{1}{2} \beta 3 \overline{y}_0^2 + \theta_1 \overline{w}_{1,0}^* + \beta 6 \overline{w}_{2,0}^* \\
& + \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \beta 7 \overline{w}_{i0}^* \overline{w}_{j0}^* + \beta 8 \overline{T}_0 + \sum_{i=1}^{2} \beta 9 \overline{w}_{i0}^* \overline{T}_0 + \beta 10\, \overline{y}_0 \overline{T}_0 + \frac{1}{2} \beta 11 \overline{T}_0^{\,2} \\
& + \sum_{k=1}^{3} \beta 12_k \overline{QD}_k + \sum_{k=1}^{3} \beta 13_k \overline{w}_1^* \overline{QD}_k + \sum_{k=1}^{3} \beta 14_k \overline{w}_2^* \overline{QD}_k
\end{aligned} \tag{15}
$$

$$
\begin{aligned}
Costn\ (w_0, y_0, \theta_0) = {} & \alpha_0 + \beta 1 \overline{y}_0 + \sum_{i=1}^{2} \beta 2_{i0} \overline{w}_{i0}^* \overline{y}_0 + \frac{1}{2} \beta 3 \overline{y}_0^2 + \beta 6 \overline{w}_2^* \\
& + \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \beta 7 \overline{w}_{i0}^* \overline{w}_{j0}^* + \beta 8 \overline{T}_0 + \sum_{i=1}^{2} \beta 9 \overline{w}_{i0}^* \overline{T}_0 + \beta 10\, \overline{y}_0 \overline{T}_0 + \frac{1}{2} \beta 11 \overline{T}_0^{\,2} \\
& + \sum_{k=1}^{3} \beta 12_k \overline{QD}_k + \sum_{k=1}^{3} \beta 13_k \overline{w}_1^* \overline{QD}_k + \sum_{k=1}^{3} \beta 14_k \overline{w}_2^* \overline{QD}_k
\end{aligned} \tag{16}
$$

$$
\begin{aligned}
Costn\ (w_1, y_0, \theta_1) = {} & \alpha_0 + \beta 1 \overline{y}_0 + \sum_{i=1}^{2} \beta 2_i \overline{w}_{i1}^* \overline{y}_0 + \frac{1}{2} \beta 3 \overline{y}_0^2 + \theta_1 \overline{w}_{1,0}^* + \beta 6 \overline{w}_{2,0}^* \\
& + \frac{1}{2} \sum_{i=1}^{2} \sum_{j=1}^{2} \beta 7 \overline{w}_{i1}^* \overline{w}_{j1}^* + \beta 8 \overline{T}_0 + \sum_{i=1}^{2} \beta 9 \overline{w}_{i1}^* \overline{T}_0 + \beta 10\, \overline{y}_0 \overline{T}_0 + \frac{1}{2} \beta 11 \overline{T}_0^{\,2} \\
& + \sum_{k=1}^{3} \beta 12_k \overline{QD}_k + \sum_{k=1}^{3} \beta 13_k \overline{w}_1^* \overline{QD}_k + \sum_{k=1}^{3} \beta 14_k \overline{w}_2^* \overline{QD}_k
\end{aligned} \tag{17}
$$

To control for variations in cost due to changes in productivity or technology, the output quantity and time trend variables were held constant across equations (15) through (17). Thus, for this study the cost of ignorance is the difference between equations (15) and (17).

Data

The study utilizes data on monthly observations of prices and quantities over the period January 1997 to June 2007. Because most U.S. wheat exported to Mexico is Hard Red Winter (HRW)[2], FOB Gulf prices for U.S. HRW grade 2 were used. Most Canadian wheat exported to Mexico is Canadian Western Red Spring (CWRS), thus FOB Pacific prices for CWRS grade 1 were used. Both U.S. and Canadian wheat prices were obtained from the ERS-USDA (2007) reports. Prices were deflated using the Consumer Price Index (CPI) for both U.S. and Canada. The indexes were obtained from the U.S. Bureau of Labor Statistics (2007) and Canada's National Statistical Agency (2007), respectively. Prices for domestically produced Mexican wheat were not available on a monthly basis, and as such, they were estimated using the Producer Price Index for wheat published by the Bank of Mexico Division of Statistics (2007). The index measures nominal prices received by farmers related to prices observed in December 2003. Mexican prices were converted from pesos into U.S. dollars using nominal exchange rates, and were deflated using the Mexican CPI.

Wheat quantities imported into Mexico from the U.S. were obtained from the Foreign Agricultural Service (FAS-USDA 2007). The quantity of Mexican wheat imported from Canada was obtained from Statistics Canada (2007). For both the U.S. and Canada, we used the aggregated wheat imports from each country, excluding durum wheat and seed wheat. Mexican wheat production volumes were obtained from the Agriculture, Food, and Fisheries Information Service Division (SIAP 2007). These quantities represent are aggregated wheat production volumes of all wheat types. About 14% of the wheat produced in Mexico is hard wheat, thus the

[2] ERS-USDA (2007) reports that from 1996/97 to 2005/06 62% of all wheat exported to Mexico was HRW. The Canadian Grain Commission (2007) reports that for the crop year 2005/06 65% of all wheat exported to Mexico was CWRS.

production quantities included in the model were the 14% of total what production reported by SIAP.

Output quantities of flour produced in Mexico were obtained from the National Institute of Statistics, Geography, and Informatics (INEGI 2007), and included first and second class flour, and wheat milling by-products. The only other data needed to estimate the model was PGI marketing expenditures, which were obtained from PGI (2007), and included both expenditures for travel to disseminate U.S. wheat information for a given crop year and website development and maintenance.

Results

To determine the appropriate model specification, several tests were conducted. First, Durbin-Watson test for autocorrelation was conducted. The Durbin-Watson tests statistics were between the lower and upper bounds critical values, and as such, no effort was made to correct for autocorrelation. Second, to determine the number of lags to include in the information equation, likelihood ratio tests were conducted. Results revealed that three lags were the appropriate specification.

Price elasticities are reported in table 1. Results indicate that Canadian wheat demand is more elastic than demand for U.S. wheat. These results are similar to Koo, Mao, and Sakurai (2001) findings that Japanese millers were more sensitive to price of high quality wheat classes. Note that Mexican wheat demand is more inelastic than U.S. and Canadian, a reasonable outcome considering that the typical practice is for milling companies in Mexico to initially demand wheat from national producers and then begin importing foreign wheat once domestic supplies are exhausted.

The estimated elasticities are reasonably close to those obtained by Marsh (2005) who found that U.S. hard red winter wheat own price elasticity was -0.864. However, Koo, Mao, and Sakurai (2001), in their analysis of Japanese wheat demand, found that U.S. hard wheat own price elasticity was -5.860. This difference might be attributable to intrinsic differences in each market. Note that the cross price elasticity between Canadian and Mexican wheat demand is negative; implying that Mexican millers would buy even small quantities of high quality Canadian wheat to mix with local wheat or imported U.S. wheat to achieve the quality required.

To estimate the value of wheat quality information, we evaluated the estimated cost function at input prices and marketing expenditures before and after PGI began operations, as depicted in equations (15)-(17). Results are reported in table 2. Note that normalized cost before PGI started operations $Costn(w_0, y_0, \theta_0)$ is higher than the cost at the same time but including PGI expenditures in the equation $Costn(w_0, y_0, \theta_1)$. Cost after PGI began operations, $Costn(w_1, y_0, \theta_1)$ is noticeably higher than the two previous cost values. Compensating variation (*CV*), surplus (*CS*) and cost of ignorance where estimated following equations (2), (5), and (6); and are reported in table 3. Results showed *CV* and *CS* are negative, implying that the released information indicated that wheat quality was not as expected. Recall that *CV* is the welfare change assuming perfect information, and *CS* is the welfare change when millers are not aware of the change in quality. These findings coincide with our expectations; if millers are unaware of the change in quality, they have a greater welfare loss than if they knew about this change. For this specific case, information about U.S. wheat did not reflect the quality Mexican buyers expected. Consequently, expenditures disseminating quality information did not increase U.S. wheat exports to Mexico. However, recognizing that wheat is lower quality than what was expected is valuable to Millers. That is, Mexican millers are better off knowing, in with more precision the quality of the wheat imported, even if their expectations are not met. The welfare loss for ignoring quality information is $60,790.340. Alternatively, the value of information expenditures to Mexican millers is estimated at $60,790.340 annually.

Conclusions

This study used compensating surplus and compensating variation concepts to measure the welfare effects for Mexican milling companies of publishing information related to U.S. wheat quality. Because it was not possible to find data to model Mexican millers' accessibility to quality information, we used the expenditures of a non-profit U.S. marketing company whose main purpose is to publish quality information and heavily promote this information to the Mexican market. The *CV* and *CS* concepts were applied to a normalized cost function.

Most parameter estimates for the system of equations were as expected. For instance, own price estimates were negative, flour quantities and time were positive implying that flour production increased over time, and time had a negative effect on real costs, suggesting that technology and other factors over time improved production efficiency. Findings showed that PGI expenditures had a negative effect on flour production costs and on wheat quantities imported from the U.S. for 2004-2007. These results were consistent with further findings that compensating valuation and surplus were negative, indicating that U.S. quality was not as Mexican millers expected, leading them to buy less wheat from the U.S.

Some of the efforts being made by members of the U.S. wheat industry to better satisfy the Mexican milling market, include giving information related with U.S. wheat quality. In this study we demonstrated that this information did not increase Mexican demand for U.S. wheat. With this we do not imply that information will consistently have a negative impact on U.S. exports to Mexico, as this might be the case for only the 2004-2007 period, and for the variability in U.S. quality with respect to Canada. This result contrasts some anecdotal evidence suggesting that the availability of quality information in recent years has led Mexican buyers to pursue wheat procurement via rail direct shipments from geographic regions where the published quality information annually shows a close match to their milling needs.

On either case, it has been demonstrated that Mexican millers are better off having extended wheat quality information, as welfare losses due to possible changes in quality are greater when millers do not have the information rather than when they actually do. Despite the limitations of this study as the limited time period of operations of PGI, our findings prove that wheat quality information does represent a value to foreign U.S. wheat buyers.

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Table 1. Price Elasticity Estimates

Country	Price Elasticity		
	U.S.	Canada	Mexico
U.S.	1.104	0.922	0.182
Canada	1.913	-1.711	-0.203
Mexico	0.596	-0.319	-0.276

Table 2. Cost for Different Average Price Inputs and Average Marketing Expenditures before and after PGI Began Operations, Holding Output Production Constant

Variable	Cost
After PGI began reporting quality, holding prices constant	$208,139.680
Before PGI began its quality reporting program	$215,057.130
After PGI began reporting quality, allowing prices to fluctuate	$240,179.550

Table 3. Compensating Variation, Compensating Surplus, Cost of Ignorance Values

Welfare Measure	Values
CV	-$6,914.450
CS	-$67,707.790
Cost of Ignorance	-$60,790.340